



PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Chiyoaki IJIMA

Application No.: 10/006,660

Filed: December 10, 2000

Docket No.: 111350

For: LIQUID CRYSTAL DISPLAY DEVICE AND ELECTRONIC EQUIPMENT

PRELIMINARY AMENDMENT

Director of the U.S. Patent and Trademark Office
Washington, D. C. 20231

Sir:

Prior to initial examination, please amend the above-identified application as follows:

IN THE ABSTRACT:

Please replace the Abstract filed with the substitute Abstract attached hereto.

IN THE SPECIFICATION:

Please replace the specification with the substitute specification attached hereto.

IN THE CLAIMS:

Please replace claims 1-19 as follows:

1. (Amended) A liquid crystal display, comprising:
a liquid crystal display panel formed of liquid crystals sandwiched between a pair of opposing substrates, and including pixels having a plurality of sub-pixels each corresponding to different colors;

an illumination device provided to an opposite side of the liquid crystal display panel in relation to an observation side that illuminates the liquid crystal display panel with illumination light;

a transfective layer disposed on the opposite side of the liquid crystals in relation to the observation side with a transmissive portion that transmits the illumination light formed thereto, the transmissive portion being formed such that a first dimension of a transmissive area corresponding to the transmissive portion of least at one sub-pixel out of the plurality of sub-pixels and a second dimension of a transmissive area corresponding to the transmissive portion at another sub-pixel, differ; and

a color filter provided corresponding to each of the sub-pixels that transmits light of a wavelength corresponding to a color of each sub-pixel.

2. (Amended) The liquid crystal display according to Claim 1, the dimension of the transmissive area at each sub-pixel being a dimension according to spectral properties of the illumination light.

3. (Amended) The liquid crystal display according to Claim 2, the dimension of the transmissive area at each sub-pixel being a dimension according to the luminance of a wavelength of the illumination light corresponding to a color of the sub-pixel.

4. (Amended) The liquid crystal display according to Claim 3, the dimension of the transmissive area at a sub-pixel of a color corresponding to a wavelength of the illumination light with great luminance being smaller than the dimension of the transmissive area at a sub-pixel of a color corresponding to a wavelength of the illumination light with small luminance.

5. (Amended) The liquid crystal display according to of Claim 1, the dimension of the transmissive area at each of the sub-pixels differs for each sub-pixel corresponding to a different color.

6. (Amended) The liquid crystal display according to Claim 1, the dimension of the transmissive area at each of the sub-pixels differing according to a position of the sub-pixel within a substrate face of the liquid crystal display panel.

7. (Amended) The liquid crystal display according to Claim 1, the transmissive portion being an opening portion formed in the transfective layer corresponding to each of the sub-pixels.

8. (Amended) The liquid crystal display according to Claim 7, the opening portion comprising opening parts of generally the same dimension that are formed mutually separated for the number according to the dimension of the transmissive area at the sub-pixels.

9. (Amended) The liquid crystal display according to Claim 1, the transfective layer having the transmissive portion formed such that an area along at least one side of a plurality of sides defining each sub-pixel serves as the transmissive area.

10. (Amended) A liquid crystal display, serving as a transfective liquid crystal display which performs displaying by switching between a transmissive mode and a reflective mode, comprising:

a liquid crystal layer sandwiched between an upper substrate and a lower substrate opposing one another;

a transfective layer which has a transmissive area that transmits light and a reflective area that reflects incident light from an upper substrate side, and which is disposed on an inner side of the lower substrate;

a color filter disposed on an upper side of the transfective layer, upon which a plurality of pigment layers with different colors according to each of sub-pixels forming a display area are arrayed; and

an illumination device disposed on an outer side of the lower substrate,

the pigment layers being formed over an entirety of an area overlapping the transmissive area in a planar manner and an area overlapping the reflective area in a planar manner, and at least one color pigment layer being formed only at a part of an area overlapping the reflective area in a planar manner,

and a dimension of a pigment layer formation area, where the pigment layers are formed, being formed so as to be different between at least one color pigment layer out of the plurality of pigment layers of differing colors and another color pigment layer.

11. (Amended) The liquid crystal display according to Claim 10, the pigment layers comprising a red layer, a green layer, and a blue layer, and the dimension of the pigment layer formation area being formed so as to be smaller for the green layer than for the red layer and blue layer.

12. (Amended) The liquid crystal display according to Claim 10, further comprising a transparent film for smoothing a step between the pigment layer formation area and the area where the pigment layers are not provided.

13. (Amended) The liquid crystal display according to Claim 10, the transmissive area being formed by the transfective layer being opened in a window-like manner.

14. (Amended) The liquid crystal display according to Claim 10, band-shaped transparent electrodes being disposed on the inner side of the lower substrate, and the transmissive area of a band shape being formed in the transfective layer by having a transparent electrode pattern width that is formed wider than a transfective layer pattern width.

15. (Amended) The liquid crystal display according to Claim 11, the transfective layer being formed of at least one of aluminum and an aluminum alloy, and the pigment layer containing the blue layer, and the dimension of the pigment layer formation area being provided so as to be smaller for the blue layer than for the red layer.

16. (Amended) The liquid crystal display according to Claim 11, the transfective layer being formed of at least one of silver and a silver alloy, and the pigment layer containing the red layer and the blue layer, and the dimension of the pigment layer formation area being provided so as to be smaller for the red layer than for the blue layer.

17. (Amended) The liquid crystal display according to Claim 10, the color properties of the color filter being adjusted by changing the dimension of the pigment layer formation area.

18. (Amended) A liquid crystal display, serving as a transfective liquid crystal display which performs displaying by switching between a transmissive mode and a reflective mode, comprising:

a liquid crystal display panel formed of a liquid crystal layer sandwiched between an upper substrate and lower substrate opposing each other, and including pixels that have a plurality of sub-pixels each corresponding to different colors and form a display area; and

an illumination device provided to an opposite side of the liquid crystal display panel in relation to an observation side that illuminates the liquid crystal display panel with illumination light;

a transfective layer disposed on an opposite side of the liquid crystal layer in relation to the observation side; and

a color filter provided above the transfective layer with a plurality of pigment layers of different colors corresponding to each of the sub-pixels arrayed thereupon, that transmits light of a wavelength corresponding to a color of the sub-pixel,

a transmissive portion that transmits the illumination light being formed on the transfective layer that includes a transmissive area that transmits light and a reflective area that reflects incident light from an upper substrate side,

and the transmissive portion being formed such that a first dimension of the transmissive area corresponding to the transmissive portion at least at one sub-pixel of the plurality of sub-pixels and a second dimension of the transmissive area corresponding to the transmissive portion at another sub-pixel, differ,

and pigment layers of each color are formed over an entirety of an area overlapping the transmissive area in a planar manner and an area overlapping the reflective area in a planar manner, and at least one color pigment layer being formed only at a part of an area overlapping the reflective area in a planar manner,

and a dimension of a pigment layer non-formation area where the pigment layer is not formed at least at one sub-pixel of the plurality of sub-pixels and the dimension of a pigment layer non-formation area at another sub-pixel, differ.

19. (Amended) An electronic apparatus, comprising the liquid crystal display according to Claim 1.

Please add new claim 20 as follows:

--20. An electronic apparatus, comprising the liquid crystal display according to claim 10.--

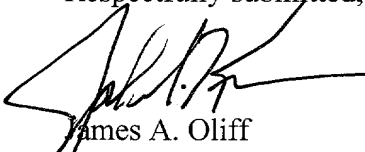
REMARKS

Claims 1-20 are pending in this application. By this Preliminary Amendment, the abstract, specification and claims are amended, and new claim 20 is added. No new matter is added.

The attached Appendix includes marked-up copies of the substitute specification (37 C.F.R. §1.125(b)(2)) and claims (37 C.F.R. §1.121(c)(1)(ii)).

Should the Examiner believe that anything further would be desirable in order to place this application in better condition for allowance, the Examiner is invited to contact Applicant's undersigned attorney at the telephone number listed below.

Respectfully submitted,


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JAO:JSK/kap

Attachments:

Substitute Abstract
Substitute Specification along with marked-up copy
showing the changes made thereto
Appendix

Date: April 16, 2002

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ABSTRACT

The present invention provides a color transflective liquid crystal display that is capable of display with good coloring and high visibility in both a reflective mode and a transmissive mode while suppressing deterioration in color reproduction caused by unevenness of the spectral properties of the illumination light, if any. The liquid crystal display can include a liquid crystal display panel including pixels formed of a plurality of sub-pixels each corresponding to different colors, and an illumination device, wherein the liquid crystal display panel includes a transflective layer and a color filter of color corresponding to each of the sub-pixels. The transflective layer includes transmissive portions for transmitting illumination light, wherein the transmissive portion is formed such that the dimension of the transmissive area corresponding to the transmissive portion of at least one sub-pixel out of the plurality of sub-pixels and the dimension of the transmissive area corresponding to the transmissive portion of another sub-pixel, differ.

APPENDIX

Changes to Abstract:

The following is a marked-up version of the amended Abstract:

~~—[Problem]—~~ To provide The present invention provides a color transfective liquid crystal display that is capable of display with good coloring and high visibility in both a reflective mode and a transmissive mode while suppressing deterioration in color reproduction caused by unevenness of the spectral properties of the illumination light, if any. The

~~—[Solving Means]—~~ A liquid crystal display ~~according to the present invention comprises~~ can include a liquid crystal display panel including pixels ~~615~~ formed of a plurality of sub-pixels ~~551~~ each corresponding to different colors; and an illumination device, wherein the liquid crystal display panel ~~comprises~~ includes a transfective layer and a color filter ~~522~~ of color corresponding to each of the sub-pixels ~~511~~. The transfective layer ~~comprises~~ includes transmissive portions for transmitting illumination light, wherein the transmissive portion is formed such that the dimension of the transmissive area corresponding to the transmissive portion of at least one sub-pixel out of the plurality of sub-pixels ~~511~~ and the dimension of the transmissive area corresponding to the transmissive portion of another sub-pixel, differ.

Changes to Specification:

A Substitute Specification is attached in accordance with 37 C.F.R. 1.125(b)(2).

Changes to Claims:

Claim 20 is added.

The following is a marked-up version of the amended claims:

~~—[Claim 1]—~~ 1. (Amended) A liquid crystal display, comprising:

a liquid crystal display panel formed of liquid crystals sandwiched between a pair of opposing substrates ~~facing each other~~, and including pixels ~~comprising~~ having a plurality of sub-pixels each corresponding to different colors;

_____ an illumination device provided to ~~the~~ an opposite side of ~~the~~ liquid crystal display ~~panel in panel in~~ relation to ~~the~~ an observation side ~~for illuminating that illuminates~~ the liquid crystal display panel with illumination light;

_____ a transfective layer disposed on the opposite side of the liquid crystals in relation to the observation side with a transmissive portion ~~for transmitting that transmits the~~ illumination light formed thereto, ~~wherein the transmissive portion is being~~ formed such that ~~the~~ a first dimension of a transmissive area corresponding to the transmissive portion ~~at of~~ least at one sub-pixel out of the plurality of sub-pixels and ~~the~~ a second dimension of a transmissive area corresponding to the transmissive portion at another sub-pixel, differ; and

_____ a color filter provided corresponding to each of the sub-pixels, ~~for transmitting that transmits~~ light of a wavelength corresponding to a color of each sub-pixel.

_____ ~~—[Claim 2]~~ 2. (Amended) A ~~The~~ liquid crystal display according to Claim 1, ~~wherein~~ the dimension of the transmissive area at each sub-pixel ~~is being~~ a dimension according to the spectral properties of the illumination light.

_____ ~~—[Claim 3]~~ 3. (Amended) A ~~The~~ liquid crystal display according to Claim 2, ~~wherein~~ the dimension of the transmissive area at each sub-pixel ~~is being~~ a dimension according to the luminance of a wavelength of the illumination light corresponding to a color of the sub-pixel.

_____ ~~—[Claim 4]~~ 4. (Amended) A ~~The~~ liquid crystal display according to Claim 3, ~~wherein~~ the dimension of the transmissive area at a sub-pixel of a color corresponding to a wavelength of the illumination light with great luminance ~~is being~~ smaller than the dimension of the transmissive area at a sub-pixel of a color corresponding to a wavelength of the illumination light with small luminance.

_____ ~~—[Claim 5]~~ 5. (Amended) A ~~The~~ liquid crystal display according to ~~any one of~~ Claim 1 ~~through Claim 4, wherein~~ the dimension of the transmissive area at each of the sub-pixels differs for each sub-pixel corresponding to a different color.

~~_____ [Claim 6] 6. (Amended) A~~ The liquid crystal display according to ~~any one of Claim 1 through Claim 4, wherein~~ the dimension of the transmissive area at each of the sub-pixels ~~differs differing~~ according to ~~the a~~ position of the sub-pixel within ~~the a~~ substrate face of the liquid crystal display panel.

~~_____ [Claim 7] 7. (Amended) A~~ The liquid crystal display according to ~~any one of Claim 1 through Claim 6, wherein~~ the transmissive portion is being an opening portion formed in the transfective layer corresponding to each of the sub-pixels.

~~_____ [Claim 8] 8. (Amended) A~~ The liquid crystal display according to Claim 7, ~~wherein~~ the opening portion ~~comprises comprising~~ opening parts of generally the same dimension that are formed mutually separated for the number according to the dimension of the transmissive area at the sub-pixels.

~~_____ [Claim 9] 9. (Amended) A~~ The liquid crystal display according to ~~any one of Claim 1 through Claim 6, wherein~~ the transfective layer ~~has having~~ the transmissive portion formed such that an area along at least one side of a plurality of sides defining each sub-pixel serves as the transmissive area.

~~_____ [Claim 10] 10. (Amended) A~~ liquid crystal display, serving as a transfective liquid crystal display which performs displaying by switching between a transmissive mode and a reflective mode, comprising:

~~_____~~ a liquid crystal layer sandwiched between an upper substrate and a lower substrate ~~faeing opposing~~ one another;

~~_____~~ a transfective layer which has a transmissive area ~~for transmitting that transmits~~ light and a reflective area ~~for reflecting that reflects~~ incident light from ~~the an~~ upper substrate side, and which is disposed on ~~the an~~ inner side of the lower substrate;

_____ a color filter disposed on ~~the~~ an upper side of the transfective layer, upon which a plurality of pigment layers with different colors according to each of sub-pixels forming a display area are arrayed; and

_____ an illumination device disposed on ~~the~~ an outer side of the lower substrate,
 _____ ~~wherein the pigment layers are~~ being formed over ~~the~~ an entirety of an area overlapping the transmissive area in a planar manner and an area overlapping the reflective area in a planar manner, and at least one color pigment layer ~~is~~ being formed only at a part of an area overlapping the reflective area in a planar manner,

_____ and ~~wherein the~~ a dimension of a pigment layer formation area, where the pigment layers are formed, ~~is~~ being formed so as to be different between at least one color pigment layer out of the plurality of pigment layers of differing colors and another color pigment layer.

_____ ~~[Claim 11]~~ 11. (Amended) A The liquid crystal display according to Claim 10, ~~wherein the pigment layers comprise~~ comprising a red layer, a green layer, and a blue layer, and ~~wherein the dimension of the pigment layer formation area is~~ being formed so as to be smaller for the green layer than for the red layer and blue layer.

_____ ~~[Claim 12]~~ 12. (Amended) A The liquid crystal display according to ~~either~~ Claim 10 ~~or Claim 11~~, further comprising a transparent film for smoothing ~~the~~ a step between the pigment layer formation area and the area where the pigment layers are not provided.

_____ ~~[Claim 13]~~ 13. (Amended) A The liquid crystal display according to ~~any one~~ of Claim 10 ~~through Claim 12~~, ~~wherein the transmissive area is~~ being formed by the transfective layer being opened in a window-like manner.

_____ ~~[Claim 14]~~ 14. (Amended) A The liquid crystal display according to ~~any one~~ of Claim 10 ~~through Claim 12~~, ~~wherein band-shaped transparent electrodes are~~ being disposed on the inner side of the lower substrate, and ~~wherein the transmissive area of a band~~

shape ~~is being~~ formed in the transfective layer by having ~~the a~~ transparent electrode pattern width ~~that is~~ formed wider than ~~the a~~ transfective layer pattern width.

~~_____ [Claim 15] 15. (Amended) A~~ The liquid crystal display according to any one of Claim 1110 through Claim 14, wherein the transfective layer is being formed of at least one of aluminum or and an aluminum alloy, and the pigment layer contains containing the blue layer, and wherein the dimension of the pigment layer formation area is being provided so as to be smaller for the blue layer than for the red layer.

~~_____ [Claim 16] 16. (Amended) A~~ The liquid crystal display according to any one of Claim 1110 through Claim 14, wherein the transfective layer is being formed of at least one of silver or and a silver alloy, and the pigment layer contains containing the red layer and the blue layer, and wherein the dimension of the pigment layer formation area is being provided so as to be smaller for the red layer than for the blue layer.

~~_____ [Claim 17] 17. (Amended) A~~ The liquid crystal display according to any one of Claim 10 through Claim 16, wherein the color properties of the color filter are being adjusted by changing the dimension of the pigment layer formation area.

~~_____ [Claim 18] 18. (Amended) A~~ liquid crystal display, serving as a transfective liquid crystal display which performs displaying by switching between a transmissive mode and a reflective mode, comprising:

_____ a liquid crystal display panel formed of a liquid crystal layer sandwiched between an upper substrate and lower substrate facing opposing each other, and including pixels that comprise have a plurality of sub-pixels each corresponding to different colors and form a display area; and

_____ an illumination device provided to the an opposite side of the liquid crystal display panel in relation to the an observation side for illuminating that illuminates the liquid crystal display panel with illumination light;

_____ a transfective layer disposed on ~~the~~ an opposite side of the liquid crystal layer in relation to the observation side; and

_____ a color filter provided above the transfective layer with a plurality of pigment layers of different colors corresponding to each of the sub-pixels arrayed thereupon, ~~for transmitting that transmits~~ light of a wavelength corresponding to a color of the sub-pixel,

_____ ~~wherein~~ a transmissive portion ~~for transmitting that transmits~~ the illumination light ~~is being~~ formed on the transfective layer ~~that comprises~~ includes a transmissive area ~~for transmitting that transmits~~ light and a reflective area ~~for reflecting that reflects~~ incident light from ~~the~~ an upper substrate side,

_____ and ~~wherein~~ the transmissive portion ~~is being~~ formed such that ~~the~~ a first dimension of the transmissive area corresponding to the transmissive portion at least at one sub-pixel of the plurality of sub-pixels and ~~the~~ a second dimension of the transmissive area corresponding to the transmissive portion at another sub-pixel, differ,

_____ and ~~wherein~~ the pigment layers of each color are formed over ~~the~~ an entirety of an area overlapping the transmissive area in a planar manner and an area overlapping the reflective area in a planar manner, and at least one color pigment layer ~~is being~~ formed only at a part of an area overlapping the reflective area in a planar manner,

_____ and ~~wherein~~ ~~the~~ a dimension of a pigment layer non-formation area where the pigment layer is not formed at least at one sub-pixel of the plurality of sub-pixels and the dimension of a pigment layer non-formation area at another sub-pixel, differ.

_____ ~~[Claim 19]~~ 19. (Amended) ~~Electronic~~ An electronic apparatus, comprising the liquid crystal display according to ~~any one of Claim 1 through Claim 18.~~